PATENT SPECIFICATION

Application Date: Nov. 20, 1933. No. 32287/33. 429,028

Complete Specification Left: Dec. 20, 1934.

Complete Specification Accepted: May 20, 1935.

PROVISIONAL SPECIFICATION

Improvements in Centrifugal Apparatus for Separating and Collecting Dust or other Solid Particles from Air and Gases

We, CHARLES HENRY WOOD CHELTNAM and CYRIL HENRY CHELTNAM, both of 188, Adelaide Road, Brockley, London, S.E.4, and both of British nationality, do hereby declare the nature of this invention to be as follows:—

This invention relates to "centrifugal" separators for separating and collecting dust or other solid particles from air and gases, and of the class in which the dust-laden air or gas is propelled into a vessel in such manner as to create therein a vortical motion. The section of the aforesaid vessel in a plane at right angles to its axis is, in most examples, circular, or substantially so; and the vessel is usually arranged with its axis vertical. The dust-laden air or gas enters adjacent to the upper end of the vessel; the dust, or denser portions of same, leaves by a spout or ports adjacent to the lower end: and the more-or-less purified air or gas leaves through a circular opening in the upper end. Commonly, the upper portion or head of the apparatus is cylindrical, and the lower portion in the form of an inverted cone or frustum of same. In some examples the head is in the form of a scroll or volute; and in most examples the air or gas-outlet has a short internal cylindrical duct attached to it.

The object of this invention is to increase the efficiency for catching dust of separators of the class above described, and also to render them effective for the purpose of grading dust, by means adapted to modify the direction and/or the velocity of flow of air or gas in the dust-eduction-pipe.

In a "centrifugal" separator as hereinbefore described, it is possible, by generating a high vortical velocity within the separator, to fling dust of very small dimensions into the dust exit. When such a separator is precipitating a dust consisting of various sizes, and in which the bulk of the larger sizes considerably exceeds that of the small, the displacement of air or gas from the dust-container, occasioned by the precipitation of the dust of large size, will cause an upward velocity in the dust-eduction-pipe or port equal to or greater than the rate of fall due to gravity of the fine dust, and thus prevent the latter from descending into the dust-container, or even expel it back into the centre of the separator to join the column of evacuative fluid.

The air or gas in the dust-pipe and dust-container is, partly as a result of the beforementioned phenomena, loaded with dust, and the average density of the mixture is many times that of the pure air or gas. This increase in density in turn prevents larger sizes of dust than those initially suspended or expelled from descending the dust-pipe, or in the case where the separator immediately joins the dust-container, from descending the latter.

Moreover, a small quantity of air or gas is entrained with the dust when the latter is flung into the dust-port or pipe, and this air or gas, on returning up the central zone of the dust-outlet to the separator, carries with it some of the finer suspended dust.

And further, when a high vortical velocity is generated in a separator as above described, the pressure in the dust-pipe and dust-container is below that of the surrounding atmosphere, irrespective of whether the dust-laden fluid is induced or forced through the apparatus, except in the latter case when some extraneous resistance is imposed at the fluid-outlet. This depression may cause air to leak inwards through the dust-gate or valve, and through defective joints, and thence into the separator through the dust-eduction-port, carrying with it some of the finer dust.

In order to avoid the loss in separation and collection efficiency occasioned in the ways above described, a quantity of air or gas equal to or greater than the displacement of the dust precipitated is drawn off from the dust-container or pipe. It will be understood from the beforegoing that the quantity of air or gas drawn from the dust-container or pipe, will be only a small fraction of that passing through the separator.

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With a vortical velocity in a separator as above described sufficient to precipitate very fine dust, the depression in the dust-pipe and/or dust-container is greater than the pressure-drop across the separator, particularly so when the dust-laden conveying medium, air or gas, is induced through the separator; and in most cases the said depression is beyond the suction-capacity of the fan or like employed for forcing or inducing the flow of air or gas through the separator.

According to this invention, an auxiliary fan, pump, ejector, or the like is employed for drawing off air or gas from the dust-container or pipe for the purpose hereinabove described.

In the case where the air or gas is drawn direct from the dust-pipe, it will be drawn through a nozzle having a mouth larger in diameter than the draw-off pipe. Said nozzle will be fixed inside and co-axial with the dust-pipe, the open end being preferably uppermost, in order that air or gas will be drawn downwards from the central zone of the dust-pipe.

In the case where the air or gas is drawn from the dust-container, a dome, cone or pocket will be provided in the top of the dust-container and project upwards and externally, the draw-off pipe being connected to the upper end of said dome, in order to prevent a quantity of dust being entrained with the air or gas drawn off.

The discharge from the draw-off fan or like may be returned to the inlet of the separator, there to mix with the ingoing stream of dust-laden air or gas; or said discharge may be led to a small filter.

In separators as hereinbefore described, for precipitating fine dusts, it is customary to provide an air-locked dust-container beneath the separator; the lower portion of said dust-container being in the form of an inverted cone or pyramid, in order that the dust may be discharged by gravity; and a valve or gate being provided both above and below the dust-container.

The form of valve usually employed has a flat slide or gate with a circular port equal in diameter to the bore of the pipe. Aforesaid slide is sandwiched between two slide-faces of rectangular shape, each of the latter having a port corresponding to that in the slide. The two aforesaid slide-faces are secured together along two opposite edges, distance-pieces or strips being provided to give clearance to the slide, in order that it may be opened and shut. In some examples a ring of felt, or other material possessing elasticity, encircles the port in each of the slide-faces and is secured thereto. The slide projects beyond the slide-faces at the two ends, more so at one end or the other according to whether the valve is open or closed. The two ends of the slide are left open to atmosphere, for the reason that the slide would be prevented from being operated due to accumulation of dust if the ends were enclosed.

It will be understood that a valve as above described will not be secure against leakage except at minute differences of internal and external or atmospheric pressure, and in order that a valve of this type may be prevented from leaking external air into the dust-pipe or port when a difference of pressure exists of the order obtained when a high vortical velocity is generated within a separator as hereinbefore described, according to this invention, means are provided for clamping the slide between the two slide-faces when the valve is either open or closed.

In one form of this invention, two cheeks are provided, one on each side of the slide, and attached to, or engaging one of the two slide-faces. Said cheeks will project towards and beyond the other slide-face, which latter will be of such width as to permit it to move freely between the two cheeks. Eccentric cams, preferably three or four in number, will engage on the back of the slide-face that is free to move between the cheeks. Two cam-shafts, each carrying either one or two cams, will each be carried in bearing-holes in the two beforementioned cheeks, the shafts being located one at each end of the slide-faces and clear of the dust-pipe, with their axes parallel to the slide-faces and perpendicular to the direction of motion of the slide. The cam-shafts will each project through one or the other of the aforesaid cheeks, and to each a lever will be attached for actuating the cams. The two cam-shaft-levers may be connected by a link, in order that all the cams can be actuated by one operation. Alternatively, the cam-shaft bearings and cams may be transposed, the cam-shafts being carried in bearing-lugs attached to the back of the slide-face which is not attached to the cheeks, and the cams then being arranged to operate on one side of holes or recesses in the cheeks. A continuous narrow circular ring of elastic material, larger in internal diameter than the diameter of the circular port, and concentric with same, will be secured to each slide-face, in order that an air or gas-tight joint may be made on each side of the slide. Preferably, each of the two aforesaid jointing rings will be held in a keystone shaped section

groove in the face of its respective slide-face. Leaf, or other type springs, will be placed between the slide-faces along the two slides adjacent to the cheeks, in order to part the slide-faces when, by the actuation of the cam-shaft levers, the compressing force is released.

In practice, the valve will be left clamped in either the open or closed position, and in order to operate it, first the cam-shafts must be turned so as to release the compression on the jointing rings; the slide may then be moved to the required position, when it will be again clamped by moving the cam-levers to the original position.

In another form of this invention, the slide-faces are clamped to the slide by means of springs, preferably of spiral form, acting on the back of either or both of the slide-faces; the bolts for compressing the springs passing through both slide-faces, and being located at the sides in order to clear the slide. Two cheeks, as hereinbefore described, will be provided, one on each side of the valve, and cams preferably two in number on each side of the valve, will be situated between the slide-faces and located at the sides so as to clear the slide. Said cams will operate on the slide-face that is not attached to the cheeks. Two cam-shafts will each be supported in bearing-holes in the two beforementioned cheeks, the axes of the shafts being parallel to the slide-faces and perpendicular to the direction of motion of the slide. The cam-shafts are situated adjacent to the ends of the slide-faces, and one of the latter, preferably that which is not attached to the cheeks, has a recess at each end, in order that the cam-shafts will clear the slide. Each cam-shaft will carry two cams, one on each side of the valve, and the cam-shafts will be provided with levers and link as hereinbefore described. Alternatively, the cam-shaft bearings and cams may be transposed, the cam-shafts being carried in bearing-lugs attached to the face of the slide-face that is not attached to the cheeks, and the cams then being arranged to operate on one side of holes or recesses in the cheeks. Jointing rings, as hereinbefore described, will be provided.

The valve will be operated by first releasing the compression on the jointing rings by actuating the cam-shaft levers, moving the slide to the required position, and finally returning the cam-shaft levers to the original position.

It is possible, by employing two "centrifugal" separators of the class hereinbefore described in series, to precipitate dust into two grades, one coarse and one fine, provided that the separator through which the air or gas-borne dust is first passed is designed for a lower vortical motion to be given to the air or gas than in the other separator. But in practice it is found that a separator having a low vortical motion will precipitate a small quantity of fine dust with the coarse, the former being shepherded by the latter. To overcome this disadvantage and in order that air or gas-borne dust may be precipitated into two definite grades by means of two "centrifugal" separators in series, according to this invention, means are provided for air-elutriating the dust passing down the dust-eduction pipe of the separator first in order of precipitation, air or gas being admitted to the dust-pipe for this purpose. In the case where the passage of the air or gas is induced through the separator first in order of precipitation, or through both separators, the pressure in the dust-pipe will be below atmospheric, and air or gas may be induced into the dust-pipe. In the case where the passage of the air or gas through both separators is forced, and the fluid-outlet of the first in order of precipitation is subject to a back-pressure due to the resistance of the second, means may be necessary to force the elutriating air or gas into the dust-pipe of the first separator; such means being a compressed-air-ejector, fan, pump, or the like.

In one form of this invention, an annular chamber is provided round a short length of the dust-pipe, and circular slots in the latter, one at each end of the aforesaid chamber surrounding the dust-pipe, provide means of communication. The hereinbefore described chamber will be provided with a tangential inlet for the introduction of the elutriating air or gas, and a cock will be provided in said inlet-pipe for regulating the supply. Air or gas will pass from the beforementioned chamber through the circular slots in the dust-pipe, and ascend the dust-pipe to join the column of evacuative fluid in the separator, carrying with it the fine dust.

In another form of this invention, the elutriating air or gas is introduced on or adjacent to the top of the dust-container, passing thence up the dust-pipe, as hereinbefore described; a valve or cock being provided for regulating the supply.

Dated the 20th day of November, 1933.

C. H. W. CHELTNAM,
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COMPLETE SPECIFICATION

Improvements in Centrifugal Apparatus for Separating and Collecting Dust or other Solid Particles from Air and Gases

We, CHARLES HENRY WOOD CHELTNAM and CYRIL HENRY CHELTNAM, both of 188, Adelaide Road, Brockley, London, S.E.4, and both of British nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to centrifugal separators for separating and collecting dust or other solid particles from air and other gases and of the class in which the dust laden air or gas is propelled into a vessel in such manner as to create therein a vortical motion. The section of the aforesaid vessel in a plane at right angles to its axis is, in most examples, circular or substantially so, and the vessel is usually arranged with its axis vertical. The dust-laden air or gas enters adjacent to the upper end of the vessel; the dust or denser portions of same leaves by a spout or ports adjacent to the lower end, and the more or less purified air or gas leaves through a circular opening in the upper end. Commonly, the upper portion of the head of the apparatus is cylindrical, and the lower portion in the form of an inverted cone or frustum of same. In some examples the head is in the form of a scroll or volute: and in most examples, the air or gas-outlet has a short internal cylindrical duct attached to it.

Examples of separators of this class are described in Specification No. 406,036.

A classifier has been proposed in which material to be classified with air, was passed through a classifying receptacle which comprised an upper portion of large diameter and several portions of successively decreasing diameter so that the said receptacle was of a form which generally tapered in steps towards its lower end, and in such a classifier it was proposed that the lowermost portion of the receptacle should be provided with slots so that the interior of the receptacle should be open to atmosphere to permit of the uncontrolled entry of atmospheric air to produce an upward air current in the receptacle to carry upwards the lighter particles that would otherwise work downwards into the hopper.

According to the present invention, a centrifugal dust separator of the class first above referred to is provided with means for effecting a transfer of air or gas to or from the dust eduction pipe through a passage which is extraneous to the separating vessel so as to modify the direction and/or the velocity of flow of air or gas in the dust eduction pipe and thereby modify the size of dust particles precipitated therein.

These means may be adapted to extract or to add air or gas from or to the dust eduction pipe accordingly as it is desired to precipitate finer grades of dust or to remove them with the air discharged from the separator, for example, for precipitation in another separator.

When air or gas is extracted, it may be returned to the air or gas inlet of the same separator from which it is extracted.

The extraction of air or gas from, or the addition of air or gas to the dust eduction pipe may be effected directly, or indirectly through the medium of the usual air locked dust container into which the dust eduction pipe delivers the dust.

The extraction or addition of air or gas from or to the dust eduction pipe may be effected by any suitable means such as an auxiliary fan, ejector or pump.

As hereinafter explained, the quantity of air or gas extracted or added is small and depends on the depression in the dust eduction pipe, and dust container when employed, and this is affected by leakage of air from the atmosphere at the dust gate or slide valve usually fitted on the dust eduction pipe, and on the dust container.

In order to minimise this leakage, the dust gates or slide valves are preferably provided with means by which they can be forced firmly against their seatings when closed. In the case where the dust eduction pipe is connected to a dust container, its valve should be provided with means to clamp it between two seatings when in its open position.

In a centrifugal separator as hereinbefore described, it is possible, by generating a high vortical velocity within the separator, to fling dust of very small dimensions into the dust exit. When such a separator is precipitating a dust consisting of various sizes, and in which the bulk of the larger sizes considerably exceeds that of the small, the displacement of air or gas from the dust-container, occasioned by the precipitation of the dust of large size, will cause an upward velocity in the dust-eduction-pipe or port equal to or greater than the rate of fall due to gravity of the fine dust, and thus

prevent the latter from descending into the dust-container, or even expel it back into the centre of the separator to join the column of evacuative fluid.

The air or gas in the dust-pipe and dust-container is, partly as a result of the before-mentioned phenomena, loaded with dust, and the average density of the mixture is many times that of the pure air or gas. This increase in density in turn prevents larger sizes of dust than those initially suspended or expelled from descending the dust-pipe, or, in the case where the separator immediately joins the dust-container, from descending the latter.

Moreover, a small quantity of air or gas is entrained with the dust when the latter is flung into the dust-port or pipe, and this air or gas, on returning up the central zone of the dust-outlet to the separator, carries with it some of the finer suspended dust.

And further, when a high vortical velocity is generated in a separator as above described, the pressure in the dust-pipe and dust-container is below that of the surrounding atmosphere, irrespective of whether the dust-laden fluid is induced or forced through the apparatus, except in the latter case when some extraneous resistance is imposed at the fluid-outlet. This depression may cause air to leak inwards through the dust-gate or valve, and through defective joints, and thence into the separator through the dust-eduction port, carrying with it some of the finer dust.

In order to avoid the loss in separation and collection efficiency occasioned in the ways above described, a quantity of air or gas equal to or greater than the displacement of the dust precipitated is drawn off from the dust-container or pipe. It will be understood from the beforegoing that the quantity of air or gas drawn from the dust-container or pipe, will be only a small fraction of that passing through the separator.

With a vortical velocity in a separator as above described sufficient to precipitate very fine dust, the depression in the dust-pipe and/or dust container is greater than the pressure-drop across the separator, particularly so when the dust-laden conveying medium, air or gas, is induced through the separator; and in most cases, the said depression is beyond the suction-capacity of the fan or like employed for forcing or inducing the flow of air or gas through the separator.

It is possible, by employing two centrifugal separators of the class hereinbefore described in series, to precipitate dust into two grades, one coarse and one fine, provided that the separator through which the air or gas-borne dust is first passed is designed for a lower vortical motion to be given to the air or gas than in the other separator. But in practice, it is found that a separator having a low vortical motion will precipitate a small quantity of fine dust with the coarse, the former being shepherded by the latter. To overcome this disadvantage and in order that air or gas-borne dust may be precipitated into two definite grades by means of two centrifugal separators in series, according to this invention, means are provided for air-elutriating the dust passing down the dust-eduction pipe of the separator first in order of precipitation, air or gas being admitted to the dust-pipe for this purpose. In the case where the passage of the air or gas is induced through the separator first in order of precipitation, or through both separators, the pressure in the dust-pipe will be below atmospheric, and air or gas may be induced into the dust-pipe. In the case where the passage of the air or gas through both separators is forced, and the fluid-outlet of the first in order of precipitation is subject to a back-pressure due to the resistance of the second, means may be necessary to force the elutriating air or gas into the dust-pipe of the first separator; such means being a compressed-air-ejector, fan, pump or the like.

In the accompanying drawings:

Figure 1 is a diagrammatic layout of a cyclone separator, with certain accessories, according to the invention.

Figures 2 and 3 are diagrammatic elevations of parts of the dust precipitating and collecting apparatus illustrating two methods of extracting air.

Figure 4 is an elevation, and

Figure 5 is a plan corresponding thereto, of a part of the dust eduction pipe with means for adding air,

Figure 6 being a plan view of a slightly modified arrangement.

Figure 7 is a diagrammatic layout of two separators, compounded in series, according to the invention.

Figures 8, 9 and 10 are, respectively, a plan and two elevations, all half sectional views, of a suitable form of slide valve for controlling the inlet and outlet to the dust container.

Figures 11, 12 and 13 are, respectively, a plan and two elevations, all half sectional views, of a modified form of valve.

Referring to Figure 1 of the drawings, a separator 1 is illustrated such as is described in Specification No. 406,036. The separator has an air inlet pipe 2 and a clean air outlet pipe 3, the passage of air through the separator being induced by a

fan or exhauster 4 connected to the outlet pipe.

The lower end of the separator terminates in a dust eduction pipe 5, which is connected to a dust container or hopper 6. The inlet and outlet of dust to and from the container is through slide valves 7 and 8, respectively. These valves are of a form hereinafter described.

A small bore pipe 9 communicates with the dust eduction pipe in order that the conditions of the air prevailing in the eduction pipe may be modified to control the precipitation of dust. Air may be drawn from the eduction pipe through the pipe 9, or air from an outside supply may be added to that in the eduction pipe. If desired, the pipe 9 may be connected to the dust container 6.

When air is to be extracted from the education pipe, by means of the pipe 9, the arrangement shown in Figure 2 may be employed. The pipe 9 enters the eduction pipe and terminates in a funnel 10 through which air is drawn. Alternatively, the arrangement shown in Figure 3 may be adopted, in which the pipe 9 is connected to a small dome or bell 11 on the top of the dust container 6, to enable air or gas to be extracted without entraining dust therewith.

Air which is extracted may be returned to the separator inlet.

When air is to be added to the eduction pipe, either of the arrangements shown in Figures 4, 5 and 6 may be employed. Referring to Figures 4 and 5, a chamber 12 surrounds the dust eduction pipe 5, and the pipe 9 introduces additional air tangentially into the chamber which in plan, may be of spiral or snail form. The inlet of air is regulated by any suitable valve. The additional air enters the eduction pipe through slots 13 therein, so that it may be distributed evenly through the dust precipitated in the dust eduction pipe to elutriate this dust and carry off the finer dust into the column of evacuative fluid in the separator. The chamber 12 may be circular in plan, as is shown in Figure 6, with the pipe 9 radially disposed thereto. Alternatively, elutriating air may be added in the dust container.

Figure 7 shows an arrangement in which two distinct separators 14 and 15 are compounded in series. Air to be cleaned enters the first separator at 16 and leaves it in a partially cleaned condition at 17. The outlet 17 of the first separator is connected to the inlet of the second, 15. The passage of the air through the system is induced by means of a fan or exhauster 18 connected to the outlet of the separator 15.

Dust eduction pipes 19 and 20 communicating with dust containers 21 and 22 are provided for the respective separators 14 and 15.

The separator 14 may be designed to have a lower vortical motion than that of the separator 15. Elutriating air may be added at 23 to the eduction pipe 19, while air is extracted from the dust eduction pipe 20 at 24[1].

When the air is forced through the separators, instead of being induced, the added air may be introduced under pressure in order to overcome any back pressure from the second separator.

Slide valves 7 and 8 are provided controlling the inlet and outlet of dust to and from the containers 21 and 22.

In order that the addition or extraction of air to or from the dust eduction pipe may be accurately determined, the valves 7 and 8 are of such a nature that they prevent undesirable leakage of air.

Referring to Figures 8, 9 and 10, the valve comprises a slide 24 adapted to be moved between two castings 25 and 26, the faces of the castings forming seats for the slide. The faces are preferably provided with resilient packing rings or gaskets 27, which can establish an air-tight joint between the seats and the two faces of the slide 24.

The castings are drawn towards one another by compression springs 28 round studs 29 which pass freely through the casting 25, and are screwed into the casting 26. The slide is thus clamped between the two seats by the pressure of the springs and an air-tight joint is made between the seats and both sides of the slide.

In order that the slide can be moved freely when it is desired to open or close the valve, provision is made to free the slide by forcing apart the seats.

The upper casting 25 has two side flanges 30, in which two cam spindles 31 and 32 are journalled having cams 33 and 34, respectively.

The spindle 31 has a crank arm 35 fixed to its end, while the spindle 32 is similarly provided with a hand lever 36. The lever 36 and arm 35 are connected by a link 37. A movement of the hand lever results in a rocking of the cams 33 and 34 into contact with the flange 40 of the casting 26 to ease the gaskets off the slide. The slide 24 can then be moved by means of a hand grip (not shown) fixed to the lugs 41 on the slide. The slide has a stop 42 to arrest it in the fully open position.

When the slide has been moved from one extreme position to the other, the cam spindles are again rocked to rotate

the cams, whereupon the springs can again clamp the slide 24 between the two gaskets.

The valve 7 should be firmly forced against its upper seating when in its closed position, in order to prevent leakage of air from outside to the dust eduction pipe above the valve. When the valve 7 is in the open position it should be firmly forced against both the upper and the lower seating, in order to avoid leakage of air into either the pipe or the dust container.

The particular construction of valve described meets these conditions, although it actually prevents leakage on both sides of the slide when in both the open and closed positions.

A similar construction of valve may be used conveniently for the dust discharge valve 8 on the lower part of the dust container, although it is only necessary that this valve be forced against its upper seating when closed.

In some cases, it is preferable to ensure that the two valves shall not be maintained open, and the arrangement shown in Figure 1 may be employed to cause one valve to open as the other is being closed.

One cam spindle of each valve has a crank arm 43. The other spindle of the valve 7 has a bell crank lever 44, which is connected by a link 45 to a bell crank lever 46 on the second spindle of the valve 8. The lever 46 has one arm extended to form a hand grip which, when moved, operates simultaneously the cams of both valves to free their slides.

The slides 24 are moved simultaneously, one opened and the other shut, by a lever 47 pivoted at 48 to a bracket 49 mounted on the dust container. The lever is connected to the two slides 24 by means of short links 50.

A slightly modified valve is shown in Figures 11, 12 and 13. In this form of valve, blade springs are used to ease the seatings off the slide, while cams are used to provide the clamping pressure.

Two castings 51 and 52 are provided with gasket rings 53 which can make a tight joint on both sides of a slide 54. Two side cheeks or plates 55 are provided, tied together by bolts 56 and distance ferrules 57. The cheeks have flanges 58 extending beneath and in contact with the underside of the flange 61 of the casting 52. The cheeks also have vertical flanges 58¹. Two cam spindles 62 are journalled in the cheeks and each spindle has two cams 63 situated above the flange 59 of the upper casting.

Blade springs 64 are situated between the flanges 59 and 61 of the two castings and tend to force them apart to free the slide 54.

Partial rotation of the cams in one direction by means of hand levers 64¹ will pull the flanges 58 of the cheeks up against the underside of the flange 61, while forcing the flange 59 downwards, so that the slide 54 will be positively clamped between the gasket rings 53 to prevent leakage of air past the rubbing surfaces of the slide. When the cams are rotated in the opposite direction, they relieve the pressure, so that the flanges 59 and 61 are forced apart by the blade springs to free the slide, so that it can be moved.

The dust container 6 is normally rigidly supported on a structure carrying the separator, and where the top of the container is made of light gauge sheet metal, it will be found that the top is flexible enough to yield to the movements of the castings forming the valve seatings. If, however, the top is more rigid, an expansion or telescopic joint may be included in the eduction pipe between the valves and the dust container, to permit of the free movement of the castings.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A centrifugal dust separator of the class referred to having means for effecting a transfer of air or gas to or from the dust eduction pipe through a passage which is extraneous to the separating vessel so as to modify the direction and/or the velocity of flow of air or gas in the dust eduction pipe and thereby modify the size of dust particles precipitated therein.

2. A centrifugal dust separator according to claim 1, having means for extracting from the dust eduction pipe a quantity of air substantially equal to or greater than the displacement of the dust precipitated.

3. A centrifugal dust separator according to claim 1, provided with an air locked dust container and having means for extracting from the dust container during the operation of the separator a quantity of air or gas substantially equal to or greater than the displacement of the dust precipitated.

4. A centrifugal dust separator according to claim 1, having means for adding air or gas to the dust eduction pipe so as to elutriate the dust passing down therein and to enable the dust of finer grade to be carried of by the air discharged from the separator.

5. A centrifugal dust separator accord-

ing to claim 1, in which the dust eduction pipe discharges dust into a dust container, having means for adding air or gas to said container for the purpose of elutriating the dust passing down the dust eduction pipe and to enable the dust of finer grade to be carried off by the air discharged from the separator.

6. A centrifugal dust separator according to claim 4 or 5, connected in series to a second centrifugal dust separator of the same class, the two separators being designed for different vortical velocities so that the dust carried over by the air or gas discharged from the first separator can be separated in the second.

7. A combination of centrifugal dust separators according to claim 6, wherein the dust eduction pipe of the second separator discharges dust into a dust container and means are provided for extracting air or gas from said pipe or container for the purpose hereinbefore set forth.

8. A centrifugal dust separator according to claim 1, 2, 3, 4 or 5, having a dust discharge slide valve between the dust eduction pipe and a dust container and means for forcing the slide valve onto one seating when closed and firmly between two seatings when open for the purposes hereinbefore set forth.

9. A centrifugal dust separator according to claim 8, having a dust slide valve on the discharge of the dust container provided with means for forcing it firmly against its seating when in the closed position.

10. A centrifugal dust separator according to claim 8, having a dust discharge slide valve on the dust eduction pipe and/or on the dust container constructed and adapted to operate substantially as hereinbefore described with reference to Figures 8, 9 and 10 of the accompanying drawings.

11. A centrifugal dust separator according to claim 8, having a dust discharge slide valve on the dust eduction pipe and/or on the dust container constructed and adapted to operate substantially as hereinbefore described with reference to Figures 11, 12 and 13 of the accompanying drawings.

12. A centrifugal dust separator according to claim 2, wherein air or gas is drawn directly from the dust-eduction pipe through a nozzle and draw-off pipe, the nozzle being arranged co-axially within the dust eduction pipe and having a mouth larger in diameter than that of the draw-off pipe.

13. A centrifugal dust separator according to claim 5, wherein air or gas is added directly to the dust eduction pipe through circumferential slots in the pipe and from an annular chamber surrounding the pipe and provided with a tangential or other inlet for the air or gas.

Dated this 20th day of December, 1934.
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52, Chancery Lane,
London, W.C.2.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1935.

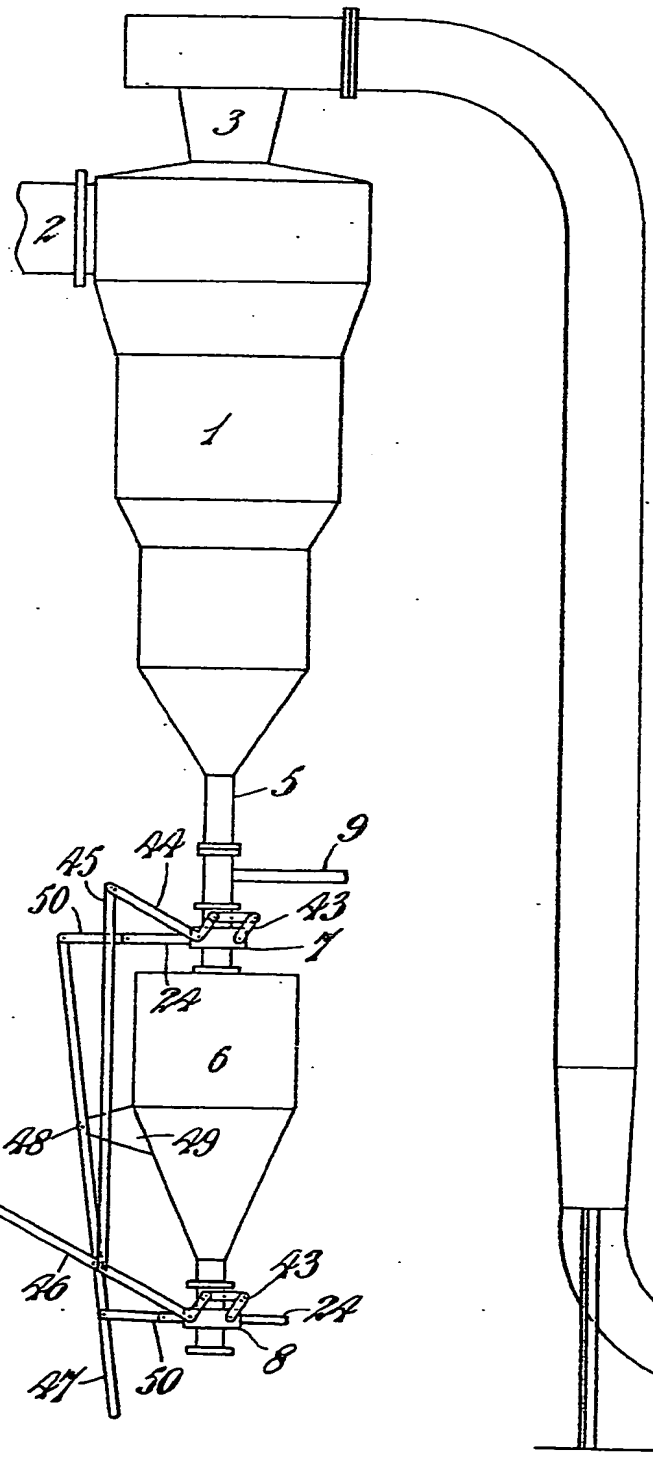
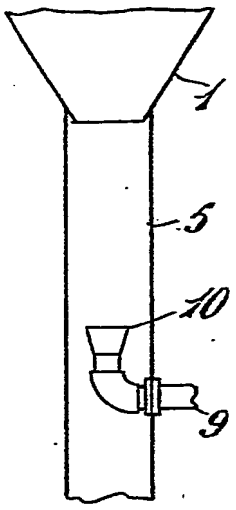


Fig. 1.

[This Drawing is a reproduction of the Original on a reduced scale.]



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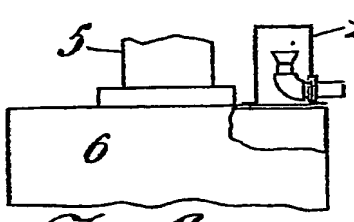

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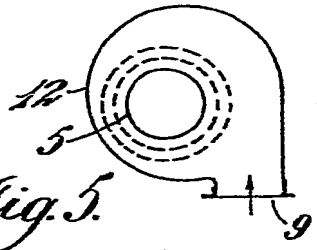

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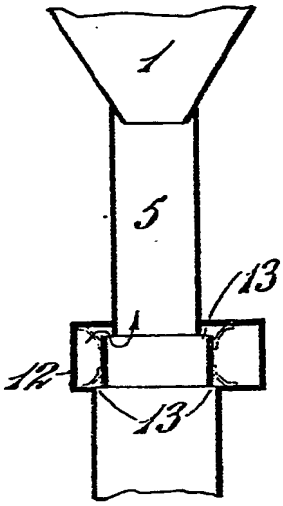

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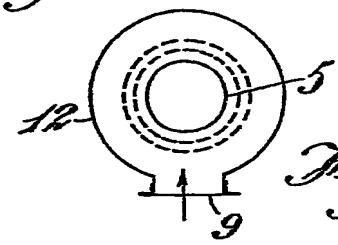

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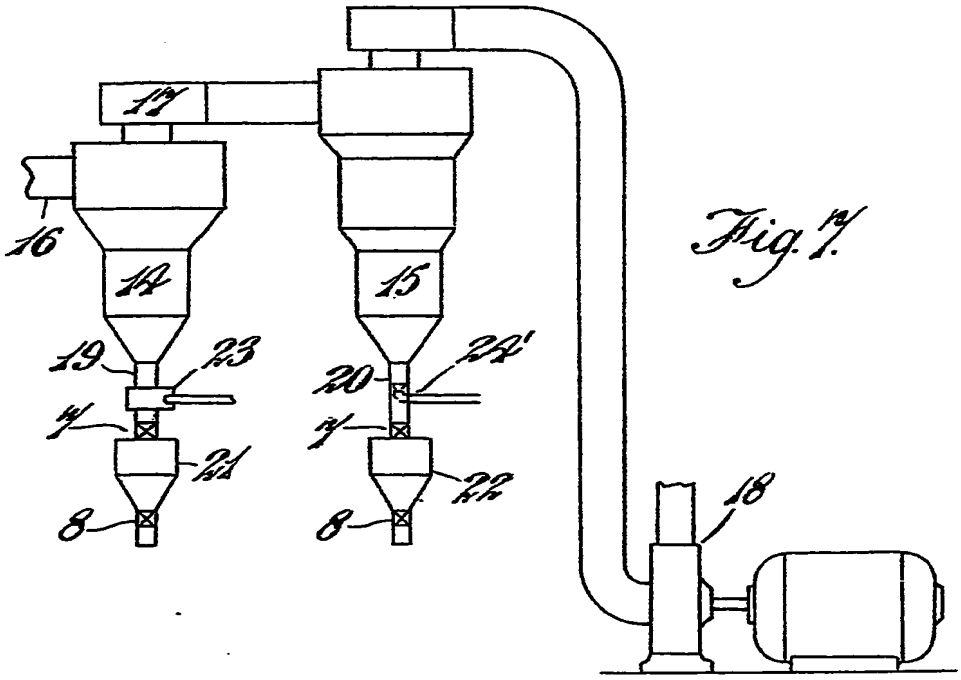
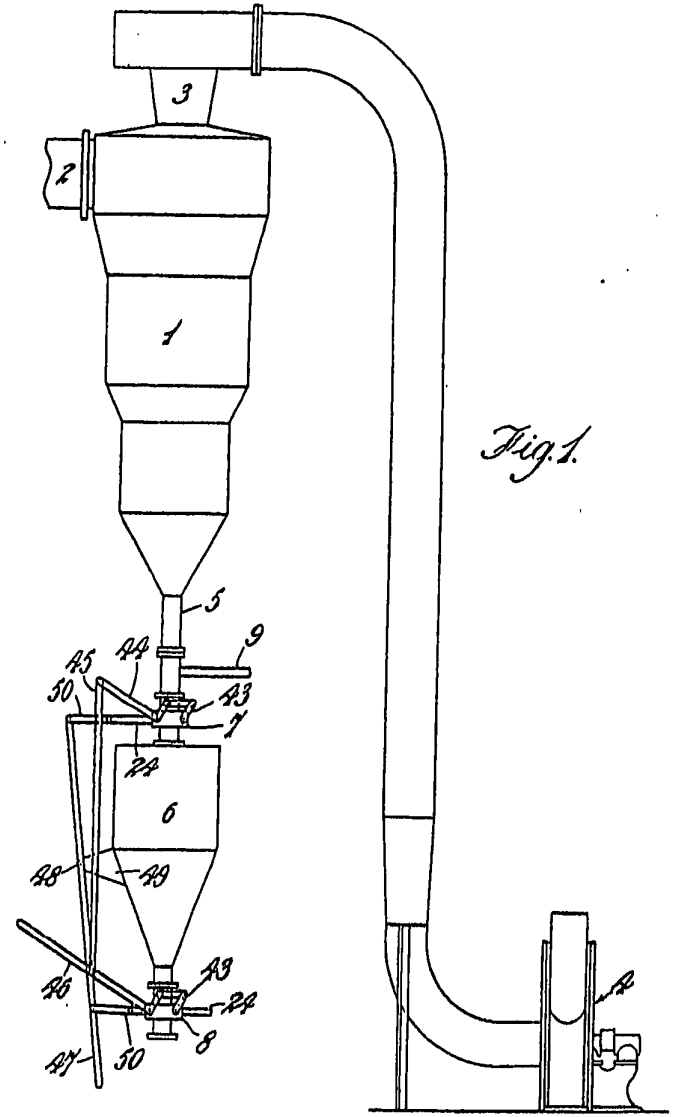


Fig. 7.

429,028 COMPLETE SPECIFICATION



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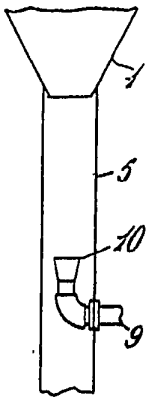

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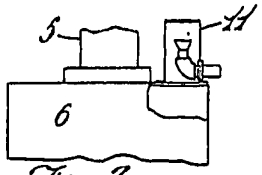

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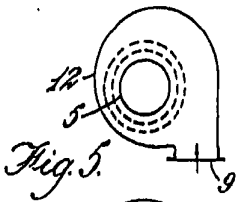

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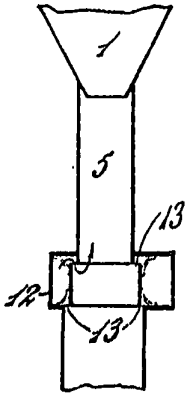

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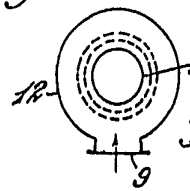

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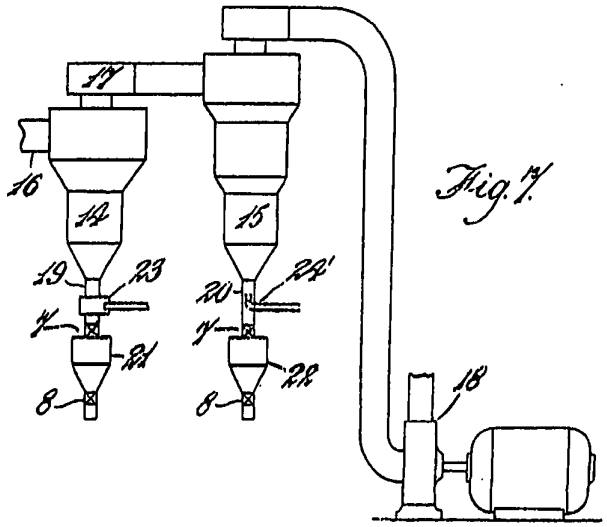

Fig. 7.

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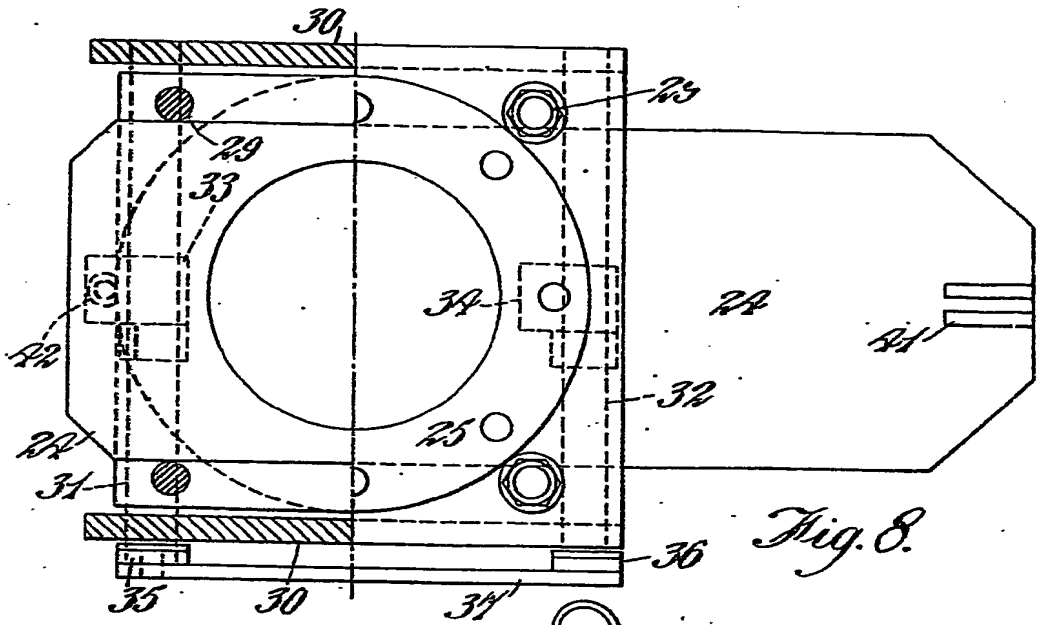
[This Drawing is a reproduction of the Original on a reduced scale.]



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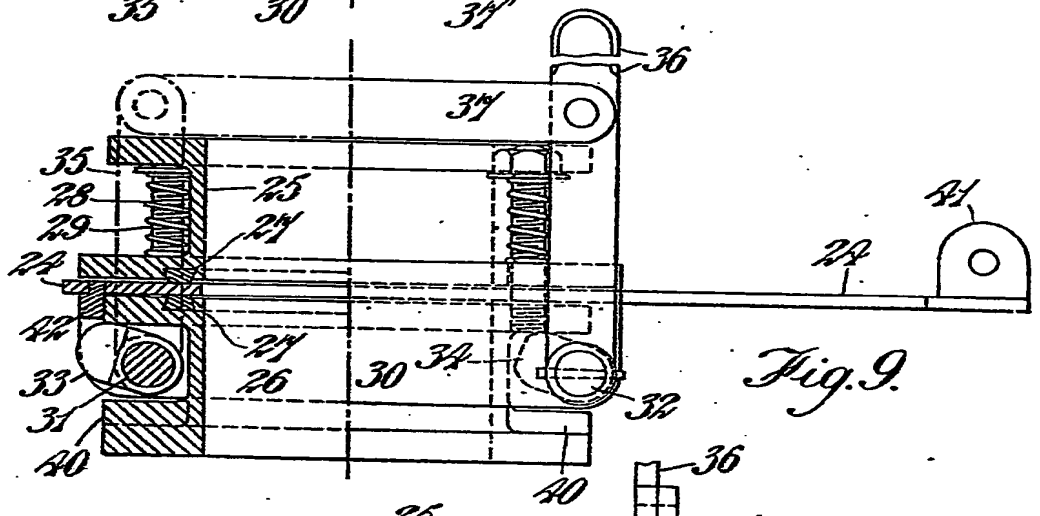

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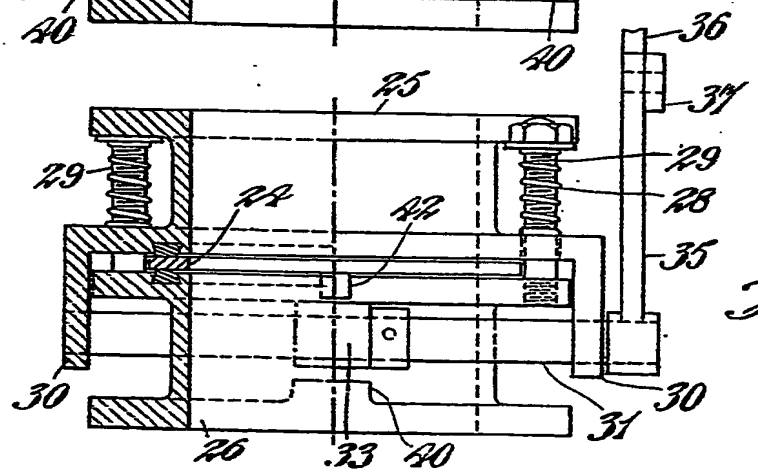

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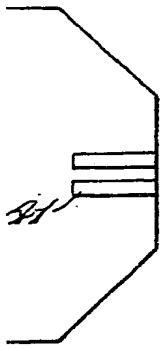

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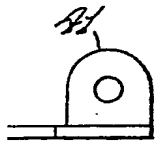

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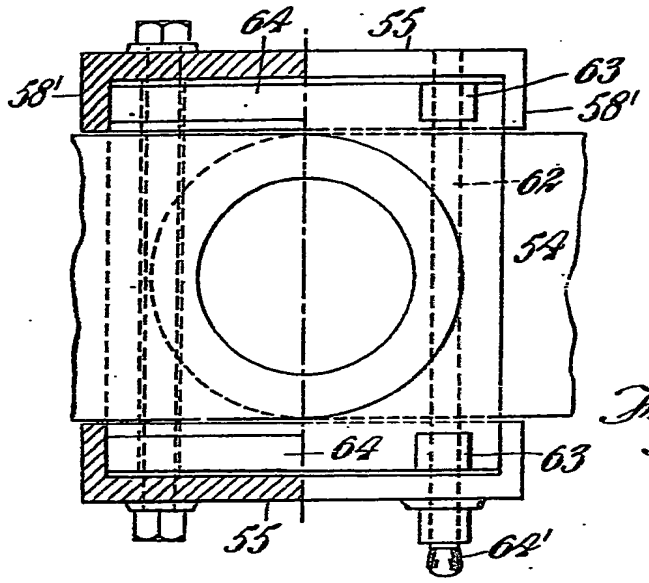

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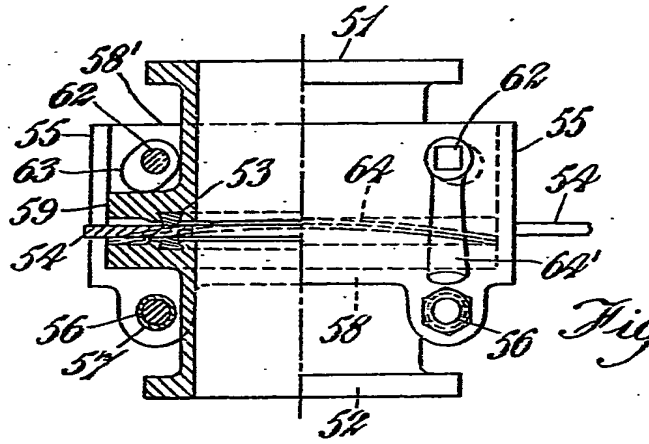

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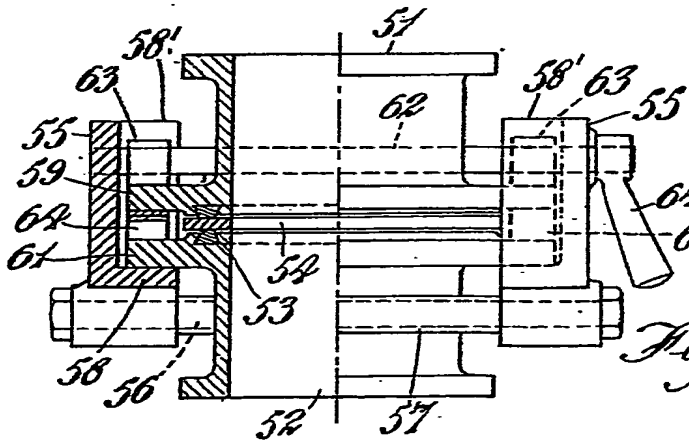

Fig. 13.

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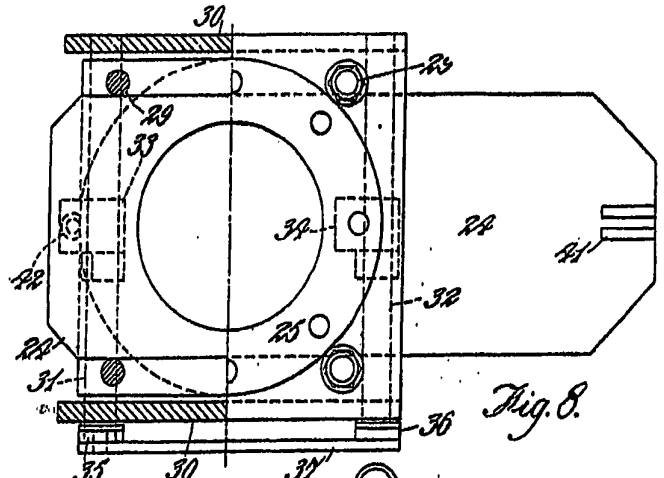

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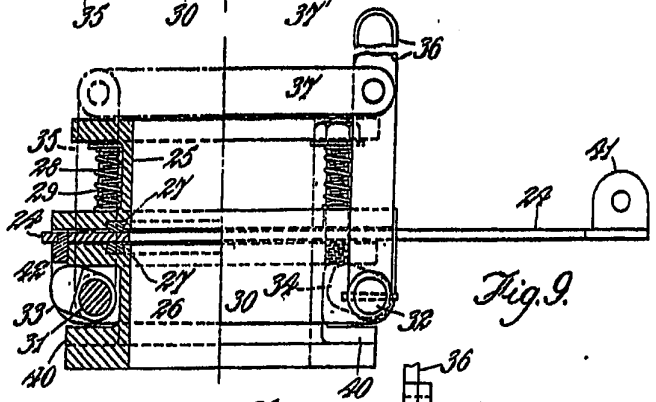

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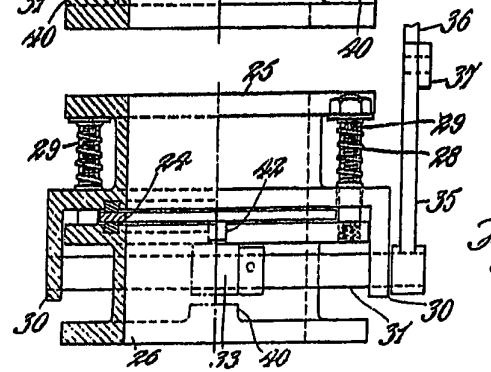

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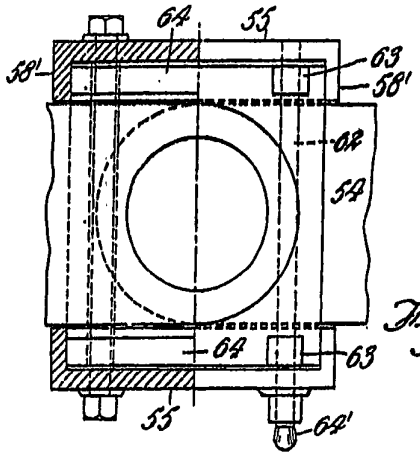

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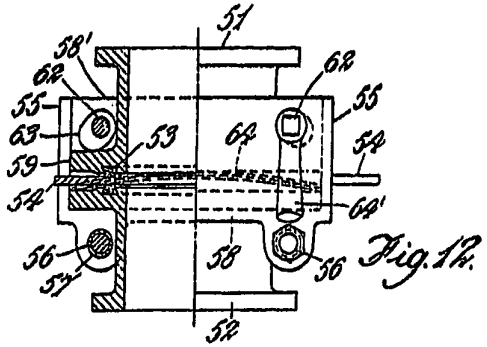

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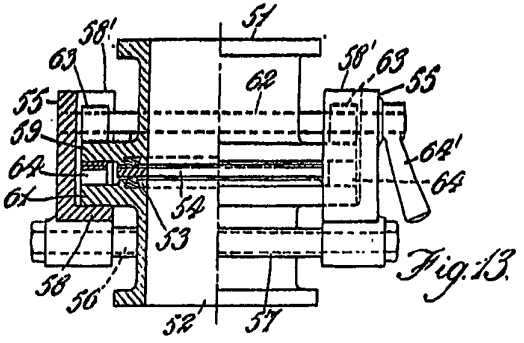

Fig. 13.

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